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The Flexigas Simulator

A decision support system for biogas chains

FLEXIGAS

W.E. Wijbrandi[1] wilco.wijbrandi@tno.nl
G. Azzopardi[1,2] george.azzopardi@tno.nl
E. Lazovik[1] elena.lazovik@tno.nl
F. Pierie[2,3] f.pierie@pl.hanze.nl
[1]TNO (Netherlands Organisation for Applied Scientific Research), [2]University of Groningen, [3]Hanze Research

Watch the movie!

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Background

- Co-digestion of biomass into biogas is important for future renewable energy mix.
  - The optimal design, planning and use of a biogas production chain is very challenging:
  - What is the biomass availability in quantity, quality and location?
  - What is the energy demand in energy type, quantity and location?
  - What is the needed machinery and infrastructure to connect them?

What do we offer?

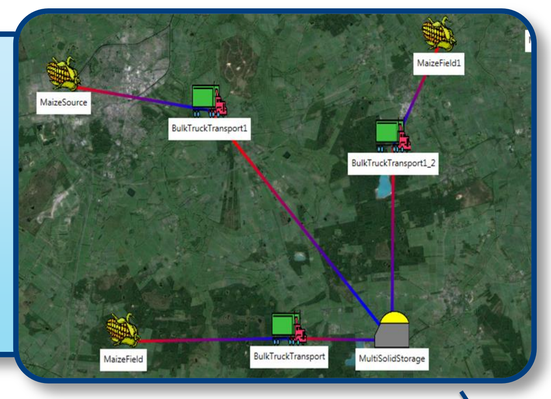
The **Flexigas Simulator**

- **Interactive** system with a **multi-touch** interface which facilitates the **decision making process** of various **stakeholders**.
- It uses a **geographical map interface** to visualize the locations of the concerned components
- Illustrates the **results graphically**, while keeping the underlying computations transparent to the users.
- It offers an **effective** and **efficient** way of running multiple **what-if scenarios** in order to optimize the processing chain.
- More …

Usage examples of the Flexigas Simulator

Build your biogas chain

❖ Build a digester: Is it profitable? What is its **best location**?
❖ Burn biogas in CHP or upgrade it to natural gas quality: what is better?
❖ Is the **chain** as a whole **profitable**?
Build the biogas chain yourself with our software, answer your questions and **try out alternatives**!

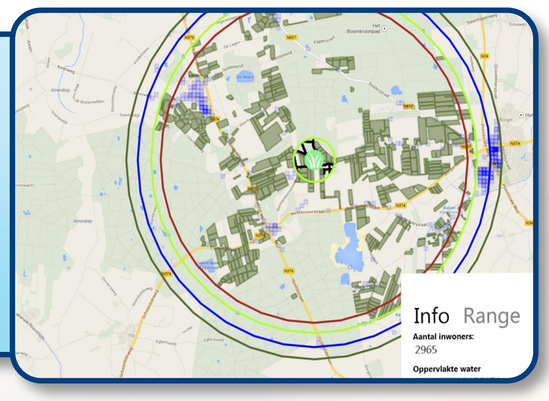


Collaborate with stakeholders

❖ The user interface can be used on multi-touchscreen, **allowing** a group of people to **design** the biogas chain **together**.
❖ The user interface is **easy** to understand, so **every stakeholder** can join the decision making process.

Integrate external information

❖ What is the biomass potential in the area?
❖ How much roadside grass can we collect?
❖ Is there demand for heat in the area?
❖ How many people live in the area?
By connecting the tool to existing GIS databases this **information** can be made **visible** during the design process.

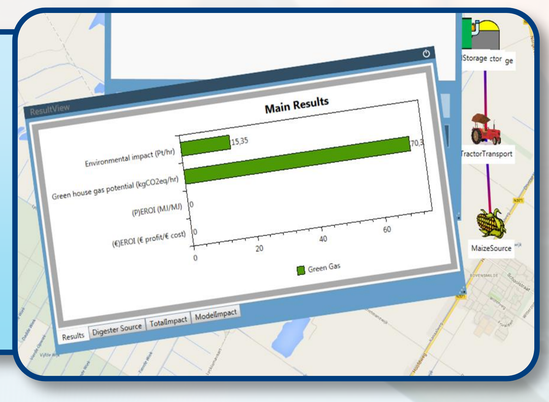


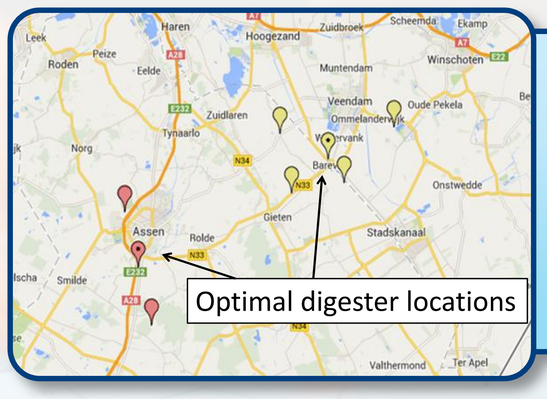
Dynamic models

❖ The model is **configurable**
❖ The model is based on Dynamic Flow Analysis and Life Cycle Analysis and it is capable of **calculating** the Energy Returned on Invested, Carbon footprint, sustainable impact and economical cost.

View the results

❖ After simulating the biogas chain, users get a quick **overview** of the **key variables**.
❖ Using the touchscreen, they can easily visualize **any variable** in the model.
❖ All values can be **downloaded** as a CSV file for further analysis.



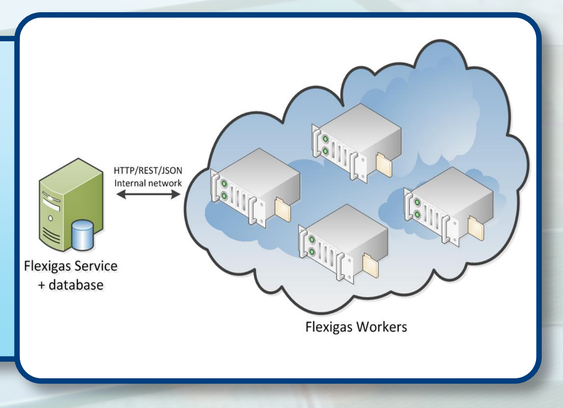


Chain optimization tools

❖ Transport of biomass is both **expensive** and energy consuming
❖ What is the **best place** to build a digester?
❖ Is it better to build one big digester or several smaller ones?
❖ What is the **optimal size** for digester?

Fast parallel execution

Detailed models for a large biogas chain can get quite complex.
❖ Trying out the different alternatives in parallel is an easy **highly interactive process** for users.
❖ Users **immediately** know the **impact** of their choices and can choose the best solution quickly.




```
end SubstrateSource;

model Stable
  parameter Integer numberOfCows;
  SubstrateConnector out1;
  CostConnector costs;
equation
  out1.substrate.organicDryMass    = 0.07;
  out1.substrate.gasPotential      = 300;
  out1.substrate.methanePotential = 180;
  out1.substrate.nContent          = 0.00532;
  out1.substrate.pContent          = 0.0017;
  out1.substrate.kContent          = 0.00713;
  out1.rate                        = numberOfCows * 18.12 / 8750;

  costs.financial                  = out1.rate * 1.84; // TODO: verify v
  costs.energy                     = out1.rate * 18.21 / 3.6;
  costs.co2                        = out1.rate * 0.87;
end Stable;
nd Substrate;
```

MODELICA

Upload your own models

Everything we know about bio gas is written down **in Modelica** models.
❖ Modelica is a language for describing the models.
❖ Users can **modify** the models or **create new** ones and upload them.
❖ Any value chain can be simulated and optimized using the tool, if you make a model for it.

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